

Before the
UNITED STATES DEPARTMENT OF COMMERCE
National Telecommunications and Information Administration
Washington, D.C. 20230

In the Matter of)
) **Docket No. 181130999-8999-01**
Developing a Sustainable Spectrum)
Strategy for America’s Future)

To: Office of Spectrum Management, NTIA
Attention: Mr. John Alden
Via: spectrum-strategy-comments@ntia.doc.gov

COMMENTS OF ROBERT BOSCH LLC
IN RESPONSE TO NOTICE AND REQUEST FOR COMMENTS

Robert Bosch LLC (Bosch), a manufacturer of various high-quality electronic products,¹ by counsel, hereby respectfully submits its comments in response to the *Notice and Request for Comments* (the Notice) in the captioned proceeding. The Notice was published in the Federal Register² on December 21, 2018.³ In this proceeding, the United States Department of Commerce’s National Telecommunications and Information Administration (NTIA) seeks comments to assist in the development of a comprehensive, long-term national spectrum strategy pursuant to a Presidential Memorandum entitled *Developing a Sustainable Spectrum Strategy for*

1 Bosch manufactures many different types of products for different industries, including vehicular electronic systems, industrial and consumer products, commercial construction products and tools, worldwide.

2 83 Fed. Reg. 65640.

3 These comments are thus filed out of time by two days. However, it is respectfully requested that, inasmuch as they are being filed by e-mail per the instructions in the Notice; because the due date for comments, January 22, 2019 fell on a day that NTIA was closed due to the government shutdown; and because these comments are being tendered on January 24, 2019, also during the government shutdown, these comments be accepted for filing and deemed timely filed.

America's Future, issued October 25, 2018. That Presidential Memorandum requires that the Secretary of Commerce, through NTIA and in consultation with (among other Federal agencies) the Administration's Office of Science and Technology Policy and the Federal Communications Commission (FCC) submit a long-term National Spectrum Strategy (Strategy) to the President, within 270 days. The Strategy is to include legislative, regulatory, or other policy recommendations to: (a) Increase spectrum access for all users, including on a shared basis, through transparency of spectrum use and improved cooperation and collaboration between Federal and non-Federal spectrum stakeholders; (b) Create flexible models for spectrum management, including standards, incentives, and enforcement mechanisms that promote efficient and effective spectrum use, including flexible-use spectrum licenses, while accounting for critical safety and security concerns; (c) Use ongoing research, development, testing, and evaluation to develop advanced technologies, innovative spectrum utilization methods, and spectrum sharing tools and techniques that increase spectrum access, efficiency, and effectiveness; (d) Build a secure, automated capability to facilitate assessments of spectrum use and expedite coordination of shared access among Federal and non-Federal spectrum stakeholders; and (e) Improve the global competitiveness of United States terrestrial and space-related industries and augment the mission capabilities of Federal entities through spectrum policies, domestic regulations, and leadership in international forums. For its comments on these topics and the basic elements of a modern spectrum management process, Bosch states as follows:

1. Bosch briefly suggests herein some very specific components of a sustainable spectrum management plan for the United States going forward. Two major components of any such plan should be: (1) to make spectrum use policies and FCC regulation of new technologies

as flexible as possible, so as to expand the use-cases for the application of radio frequency (RF) energy beyond those permitted now; and (2) to expedite the process of accommodating new technologies, consistent with the rapid but comprehensive evaluation of interference potential to incumbent services. The full development of the Internet of Things calls for expanded use of compatible spectrum overlays in fully assigned spectrum and the flexibility to apply those overlay uses so as to maximize connectivity and spectrum efficiency.

2. In Bosch's experience, both NTIA and FCC are extremely conservative with respect to authorizing new wideband applications that will overlay narrowband allocations. This reluctance to authorize wideband spectrum overlays persists despite years (in some cases decades) of experience illustrating, at least anecdotally, compatibility with incumbent spectrum uses. Indeed, perhaps one reason for this conservatism in authorizing new technologies is that the spectrum management processes and procedures utilized in the United States are vastly different than those used in the International Telecommunication Union (ITU) for international spectrum planning. They are also quite different from processes used by the ECC and ETSI for spectrum planning. In Europe and at the ITU, compatibility studies and technical showings are used as the basis for determining compatible sharing of spectrum. In the United States, the FCC rulemaking process tends to be much more anecdotal, policy-oriented and non-technical. There are not always technical compatibility analyses completed before a spectrum sharing proposal is adjudicated. This leads to delays in spectrum management decisionmaking that last for years where there are competing users and services. These delays frustrate research and development of new products. It vastly increases the time it takes to bring those new products to the domestic marketplace; it increases cost of the products, and it decreases the useful life of the products. Worse, it frustrates connectivity that is the cornerstone of the Internet of Things.

3. This is not at all to denigrate the good work performed by NTIA's spectrum management office. That office regularly provides professional and impartial evaluations of new technologies; it is accessible, and the staff has an understandable and proper focus on the interference potential of those technologies to government exclusive and shared Federal and non-Federal spectrum. The work of that office addresses directly the technical necessities of interference prevention and electromagnetic compatibility. But both NTIA and FCC should be aware of the damaging effect of the slow pace at which new technologies are authorized in the United States, and the extent to which that hampers the United States' competitiveness in facilitating new product development and its timely arrival in the marketplace domestically.

4. Perhaps the best example of the overly conservative approach to regulation of new technologies and the most urgent need to provide increased flexibility in spectrum management is with respect to the FCC's regulations governing Ultra-Wideband (UWB) devices and systems. Amendment of the FCC rules and NTIA policies with respect to UWB systems, which is long overdue by reference to FCC's own proposed timetables for such review, can facilitate the development and provision of new, innovative UWB products in the United States marketplace by manufacturers and permit compatible spectrum overlays in *many* frequency bands. The failure to do this, on the other hand, will be to continue the *status quo*, in which many such products, systems and entire use-cases are not permitted by the current UWB rules. The current, highly restrictive regulatory environment is due to the consistent application of an intentionally created, overly conservative spectrum management paradigm created for this technology by the FCC seventeen years ago. Even if originally justified, experience with UWB technology since that time has demonstrated that interference fears of both NTIA and private sector telecommunications entities, expressed long ago in FCC Docket 98-153 relative to UWB

overlays in allocated spectrum used for narrow bandwidth emissions, were unfounded.⁴ The exceptionally conservative regulations adopted initially (and not substantively reviewed since that time) are not necessary to prevent interference to narrow bandwidth incumbents. Nor is there evidence of increases in ambient noise from individual or aggregate UWB devices and systems that have become operational during the long interval between 2002 when the rules were first adopted, and the present time. There is also a need to harmonize the UWB rules with those in Europe and elsewhere to facilitate a worldwide marketplace for standardized UWB products. Such harmonization would be a benefit to United States manufacturers and consumers of the products.

5. The UWB rules that should be reviewed now include technical rules applicable to the testing and equipment authorization of all UWB systems (which were adopted in 2002), and the definitional and operational rules that limit the categories of UWB devices and systems that can receive grants of certification under the Commission's equipment authorization procedures, and hence the ability to market and sell the products to end users. The current UWB rules (principally but not exclusively the technical and definitional rules) are so stringent that of necessity, virtually all new UWB products and systems must apply to the FCC for, and be subject to a waiver as an incident of being granted certification for marketing and sale of the device in the United States. There is a well-established and acknowledged need to revisit the UWB rules – something that the FCC promised seventeen years ago to do but did not do – to allow new, useful, innovative and spectrum-efficient UWB products to be brought to the United States marketplace, as they are now in most other countries of the world.

⁴ Bosch is not aware of a single reported instance of interference attributable to UWB transmissions (where permitted by current regulations) on an unlicensed basis.

6. There has been in the last decade a substantial increase in sharing of bands between Federal and non-Federal users (a trend which will inevitably become even more pronounced in the near future). A spectrum management policy that facilitates and expedites the rollout of new RF technologies, especially wideband and UWB technology, based on electromagnetic compatibility analyses establishing a high likelihood of compatibility, could improve the efficiency of the process, reduce the cost of the products, and expedite the supply chain and the product rollout to the consumer. Spectrum allocation decisionmaking at FCC (sometimes involving the consultative process with NTIA relative to non-exclusive Federal allocations) is now measured in years, and the inefficiency and cost of the existing processes works very much to the disadvantage of virtually all non-government spectrum users and especially proponents of new technologies, including manufacturers. It also substantially increases the cost of the products, delays the delivery of the product to the marketplace, and decreases the useful life of the product. It is a formula that no longer works in the global marketplace or in the connectivity process for the Internet of Things.

7. Flexible use and spectrum overlay mechanisms are workable and stand to increase spectrum efficiency when implemented prudently, correctly, and timely. But a key to the success of a new spectrum management plan, and for efficient spectrum re-use is to facilitate, to the greatest extent possible, unlicensed applications for short-range and ultra-short-range devices and systems. UWB technology is a useful technology for unlicensed applications especially,⁵ and there is a need for additional unlicensed spectrum to be made available to the Internet of Things.

⁵ This is true for several reasons: (1) the UWB emission is, at minimum, 10 dB below the typical spurious emission requirement of a traditional transmitter or 10 dB below the spurious emission requirement of a traditional transmitter or 10 dB below the EMC requirement; (2) the bandwidth requirements for traditional communications systems (for example, WiFi bandwidth went from 20 megahertz to 160 megahertz); and (3) Power consumption using UWB emissions has considerably better power consumption relative to the data rate, which creates an environmental benefit.

It is clear that UWB systems are not yet available as a complete substitute for other technologies such as WiFi. But it would be, with some additional flexibility, an alternative to other technologies for communications up to 3 meters, which would facilitate the use of location tracking communications and surveillance and material-sensing. It is important in this process for worldwide UWB harmonization of regulations and spectrum availability. The regulations that result from the requested study should permit UWB device use-cases to be as flexible, inclusive and generic as possible and aligned with the ECC definitions, which are more functional than is the case in the United States.

8. There is currently a great deal of pressure on the bands below 10 GHz in which higher power, wide bandwidth, unlicensed devices can operate. Expanding the amount of spectrum that is available for unlicensed devices and permitting flexible use in these bands will decrease the pressure on the existing unlicensed bands below 10 GHz, including 902-298 MHz, 2450-2483.5 MHz, and 5725-5850 MHz.⁶ But new unlicensed spectrum for wide bandwidth digital devices should not all be in the bands below 10 GHz. Bands above 95 GHz generally, and specifically around 120 GHz offer excellent short-range opportunities for American manufacturing and for the Internet of Things. The bands above 95GHz offer the possibility of new, unlicensed UWB operation for, as but one manufacturing example, radiodetermination equipment. The ECC is currently studying these applications and the development of the millimeter-wave bands above 95 GHz. The FCC has an outstanding docket proceeding⁷ on the same topic. UWB operation in

6 UWB operation below 10 GHz is well-suited for manufacturing in indoor environments for material investigation applications; and it is also useful outdoors for long range tracking applications.

7 See, Docket 18-21, a *Notice of Proposed Rule Making and Order*, FCC 18-17, 83 Fed. Reg. 13888, released February 28, 2018. The FCC in that proceeding proposes to amend, among other regulations, its Part 15 rules with respect to the bands above 95 GHz, in order to accommodate the development of, and to enable new innovative services and technologies. Specifically, the *Notice* proposed rules permitting licensed, fixed point-to-point operations in large portions of that spectrum between 95 GHz and 275 GHz; making portions of that spectrum

unlicensed, flexible use bands above 95 GHz would offer a very useful opportunity for near-field environmental sensing for autonomous robots and autonomous vehicles. Applications principally include, as examples, radiodetermination applications such as foreign object detection; living object (i.e. physical presence) detection; vehicle driver state sensors (which can reveal driver medical conditions or the position of the driver); gesture control and recognition for use inside vehicles, and home automation systems. Such sensors within the millimeter-wave range can also be used for such industrial applications as high-resolution obstacle detection for autonomous systems (including industrial robots); displacement measurement (for example, fuel injection diameter changes or thickness measurements) and flow measurement. These are just a few examples. Flexible use of the millimeter wave bands is necessary in order to permit a very significant expansion of industrial, commercial and personal products and applications using these bands for radiodetermination purposes. Generally speaking, these use cases are permitted in Europe now due to more flexible regulatory provisions than exist under current FCC rules. In the security and industrial environment, UWB operation in the bands above 95 GHz enables metal or object detection, tracking and 3D radars, and other applications. In the United States, however, the millimeter-wave bands have been typically overregulated, in that they are included in the Part 15 restricted bands pursuant to Section 15.205(a) of the FCC's rules. Flexible use of these bands is indicated due to the extensive frequency re-use possibilities; the typically short range of communications paths; and the many opportunities for use of these bands for products

available for unlicensed use; and creating a new type of experimental license, for the development of new services and technologies between 95 GHz and 3 THz without limits on geography or technology.

with low radiated emission levels such as radiodetermination, with inherently low interference potential.⁸

9. There are two other points Bosch would make with respect to the goals of NTIA in this proceeding. First, neither FCC nor NTIA has ever conducted a reliable evaluation of ambient noise in the radio spectrum over time, and neither agency is adequately cognizant of trends, upward or downward, in terms of man-made noise. *No new spectrum management paradigm premised on flexible uses can be complete unless these trends are studied and factored into the planning for spectrum overlays.* Allowing certain spectrum overlays in formerly exclusively allocated bands may appear reasonable anecdotally, but in the future, increases in ambient noise in the subject bands resulting from, for example, aggregate deployment of millions of mobile, itinerant, unlicensed devices may make those same overlays incompatible with incumbent services. It is timely to adopt, as part of a sustainable spectrum management protocol, a plan to study and determine, identify and quantify the RF environments in which the radio services that are subject to recommended spectrum management policies operate.

⁸ According to ETSI System Reference Document TR-103-498 – v.1.1.1.:

(The use of microwaves provides) a very robust measuring principle which is preferred when high accuracy is required and environmental conditions, such as temperature, pressure, etc., may vary. Some of the main advantages of microwave technology for all kinds of sensors are therefore:

- high measurement accuracy,
- high repeatability,
- robust measuring performance in a variety of environmental- and process conditions,
- high reliability,
- minimum or even no maintenance requirements and wear as a result of no moving parts,
- easy installation,
- non-contact measuring principle provides a high independency of ambient conditions or process properties, superior long-term stability resulting from self-calibration mechanisms since devices have always stable internal references which are independent of temperature or humidity,
- efficient handling of many devices due to the support of different interfaces, the antenna or the radome is usually very robust against contamination with dust, dirt or other adverse environmental influences.

All these factors combined provide a technology that over time has proven to bring improvements in environmental protection, human safety, accident prevention and avoidance as well as a more efficient and sustainable use of natural resources and higher quality of end-products in different manufacturing industries.

10. A critical element in a sustainable spectrum management policy is to expedite the means by which next-generation technology is facilitated and rolled out. An illustration of the difficulties in the current process is the current, rather polarized debate over the implementation of 5G technology and flexible use of the 3.7-4.2 GHz band. The issues in the ongoing FCC proceeding on this topic pit incumbent Fixed Satellite Service (FSS), receive-only Earth station users against the FCC-proposed overlay of commercial service providers. Neither use seems fundamentally compatible with the other in shared spectrum, and indeed the commercial service providers and the incumbent FSS users seem to acknowledge this. FCC appears poised, based on its assumption that auctions lead to the most efficient use of spectrum in every case, to conduct auctions of the entire band, using wide-area market definitions. Bosch would suggest that precisely the opposite is true in context: smaller areas of 5G deployment and use of private local networks (versus large market definition and auction of spectrum to commercial service providers exclusively), subject to local, private sector coordination may provide an exceptionally high level of frequency re-use on a geographic sharing basis; compatibility with incumbent FSS satellite service users; and a rapid means to realize the benefits of Industry 4.0,⁹ the next generation of manufacturing using 5G technology. The point is that with respect to efficient, flexible rollout of next-generation broadband services, one allocation process does not effectively serve all purposes and it is impossible to generalize as FCC has done to date in the 5G proceeding. The establishment of private 5G local networks in the band 3.7-4.2 GHz is an urgent component to the FCC's proper focus on timely rollout of 5G mobile and fixed operation in that

⁹ Industry 4.0, oversimply defined, is the digital transformation of industrial markets with smart manufacturing currently on the forefront. Also referred to as the "fourth industrial revolution" in discrete and process manufacturing, logistics and supply chain, it is useful in the chemical industry, energy, intelligent transportation, utilities, oil and gas, mining and metals and other segments, resources industries, healthcare, pharmaceuticals and even smart cities.

band. The availability of these private local networks constitutes a highly flexible and preferential means of allocation of radio service throughout the United States pursuant to the statutory obligation of the Communications Act of 1934, as amended. *See*, 47 U.S.C. § 307(b). Private 5G local networks in support of the fourth industrial revolution in manufacturing can be implemented quickly and compatibly with incumbents. Industry 4.0 concepts are currently being implemented in Germany and considered throughout Europe. Bosch would be pleased to provide a full briefing on the specifics of Industry 4.0 and the European model of private 5G local networks. The success of Industry 4.0 is dependent on the integration of 5G technology at the local level. It promises a great leap forward in industrial efficiency and output with unlimited future potential.

11. To summarize, the existing spectrum management process does not always lead to compatible overlays, or to timely, flexible rollout of new technologies, and the process is certainly not efficient now. There are important technologies, most notably UWB, that have been held back by existing FCC regulations, despite decades of experience and an apparent, complete absence of interference complaints. A reduction of regulatory constraints on UWB technology would be very useful in the development of new short-range, unlicensed electronic products which offer the efficiencies of compatible sharing with narrower bandwidth incumbents, both below 10 GHz and in the millimeter wave bands above 95 GHz. In any case, a successful spectrum management plan going forward must include expeditious rollout of new products and new technologies; flexible use unlicensed bands for short-range application research and development; the use of technical compatibility studies and increased transparency; and a partnership between and among NTIA, FCC, manufacturers, their customers and the public.

Bosch would appreciate the opportunity to present additional proposals for the development of a sustainable, yet efficient and responsive spectrum management plan for the future.

Therefore, the foregoing considered, Robert Bosch LLC hereby respectfully requests that NTIA take these comments into consideration in its planning and future processes looking toward reforming spectrum management and establishing a sustainable spectrum management policy for the United States.

Respectfully submitted,

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